AMENDMENTS TO THE SPECIFICATION

Replace the paragraph beginning on page 1, line 12 with the following amended paragraph:

Multi-effect distillation (MED) process has been used in industry for juice evaporation, to concentrate a substance, for production of salts and for salty and marine water distillation for fresh water production. Different processes have been used worldwide for desalination, for fresh water production. Major processes commercially available are membranes (reverse osmosis and electrodialysis) and thermal. Distillation is a thermal process that can be divided in three different methods: multi-stage flash distillation (MFD); multi-effect distillation (MED) and ~~vapour~~ vapor compression. These processes can be used also to concentrate a substance as the object purpose.

Replace the paragraphs beginning on page 1, line 16, with the following amended paragraphs:

In the MED process ~~In distillation processes~~, only a portion of the concentrate submitted to the heat transfer surfaces is evaporated. Each effect works in a specific equilibrium ~~vapour~~ vapor pressure state. The remaining liquid of each effect, normally called brine, is the entrance feed to the next stage, where part of it flashes into ~~vapour~~ vapor.

~~In the MED process,~~ Produced ~~produced~~ ~~vapour~~ vapor in one effect will give up heat to boil the liquid transferred to the next effect due to the temperature difference between them, and several constructive models have been based on the type of evaporators used and on the creative design and arrangement distinctly disclosed in many patents worldwide.

Replace the paragraph beginning on page 1, line 24 with the following amended paragraph:

Sometimes the effects or stages have evaporators located in separate vessels, having the disadvantages of requiring a pipeline for conducting ~~vapour~~ vapor from one stage to the next, and the necessity for more room, as shown in the US Patent numbers 3884767, 3261766 and 3021265. When these stages are assembled in only one vessel, the construction can have the stages arranged in multi stack vertical falling film evaporators as disclosed in the US Patent numbers 4334954, 6089312, 6309513, ~~and~~ 3487873, and 6089312, all involving falling film type evaporators. Comment must be made to the Sephton (6309513) and Biar et al. (6089312) patents that [[is]] are not [[a]] multi-effect apparatus but a parallel stack of evaporators.

Amend as indicated the following two paragraphs that were previously inserted after page 1, line 27:

Vertical Tube Evaporators (VTE) have basically two different evaporation systems: falling film and rising film evaporation. As widely described in technical literature, falling film evaporators have high heat transfer coefficients, but the proper design of the liquid distribution system is critical to achieve full and even product wetting of the tubes, with higher risk of having so-called dry spots or film breakdown or ~~vapour~~ vapor blanket, that causes a lowering of heat transfer and is the cause of plugging by scale.

~~Vapour~~ Vapor compression process has the great advantage of a low energy consumption and a high energy efficiency, but has the disadvantage of higher maintenance costs associated with down-time operations per the rotary equipment involved, as the compressor and respective driver, and sometimes the whole evaporator as disclosed in the single stage apparatus of US Patent number 6695951. ~~The apparatus related to the US Patent number 4082616 is completely obsolete now due to these problems, besides higher scaling occurrences due to the high operational temperature.~~

Replace the following paragraphs beginning on page 1, line 29 with the following amended paragraphs:

Intended to improve the performance and reduce the height dimensions of such distillers, the present invention was developed using rising film evaporators, in a multi-effect apparatus. The ~~solution to have a compact vessel containing the whole stages, without having a vertical stack, was to assemble the~~ several evaporators are assembled in a concentric disposition, using a shell and tube exchanger for the first stage and a bundle of tubes for the succeeding stages, which are inserted one inside each other[[,]] and connected in series on a horizontal base. If not developed on this disposition, this apparatus will need a pump to push sea water to the higher stages, and necessarily will have its dimensions increased upwardly and no reduction in height would be accomplished.

~~The advantages of using rising film evaporators are listed below:~~

~~a- Less tendency for scaling formation on the interior of evaporator tubes due to the uniform and even distribution of the solution on the bottom of apparatus in an ascending stream with tubes fill-up, dispensing devices as sparger holes and plates for distribution of entrance fluids, as mentioned per Biar et al. (6089312) and Sephton (6309513);~~

~~b- High degree of turbulence in the interior of tubes that is advantageous during evaporation of fluids that have a tendency to scale the heating surfaces;~~

~~c- High heat transfer coefficients as per the high turbulence.~~

Through this constructive arrangement, the following advantages are achieved:

[[d-]] material reduction due to the absence of ~~vapour~~ vapor pipelines;

[[e-]] ~~vapour~~ vapor friction losses reduced to a minimum;

[[f-]] smaller size due to the compactness of the concentric disposition of evaporators;

[[g-]] no heat loss to exterior in the inner stages; and

[[h-]] cost effectiveness ~~and higher performance due to the less vulnerability for scale tendency due to the rising film evaporators in all stages~~.

Amend the paragraph beginning on page 4, line 8 and add a following paragraph describing new Figure 17 as shown:

Figure 16 is the elevation view in cross section of the four stage model; and [[.]]

Figure 17 is a cross-sectional view similar to Figure 13 but representing the third stage evaporator of a four stage model.

Replace the paragraph beginning on page 4, line 14 with the following amended paragraph:

Figure 1 shows the two stage model 55 with its evaporators 61, 71 assembled in the concentric arrangement where is observed that the ~~second~~ final stage evaporator 71 (Fig. 5) is assembled inside the first stage evaporator 61 (Fig. 3), supported and bolted at the flange 1 (Fig 3). The concentric stages are connected for operation in series, as is the case for the other models to be subsequently described. A gasket is used to avoid leakage. The final stage upper vessel 76 enclosing the final stage upper vapor chamber 75 (Fig. 7) with the condenser 2 inside, is assembled bolted in the same flange 1.

Replace the paragraph beginning on page 4, line 21 with the following amended paragraph:

On figures 2 and 3, is observed that the first stage evaporator 61 is constituted of a shell and tube exchanger without part of the central tubes, here called Ring Shell and Tube Evaporator. The inner wall 3 and the exterior wall 51 enclose the hot water throughout the interior of the shell, returning for heating on outlet 5.

Replace the paragraph beginning on page 4, line 27 with the following amended paragraph:

Salt water feeds the first stage evaporator 61 annular vertical tube bundle 62 on nozzle 6, passing throughout the feed chamber 7, constituted by ~~the upward~~ a downward extension 65 of the external wall [[3]] 51, limited on the bottom by flange 52 and on top by tubesheet 53. Feed water is directed to the first stage tubes 8, receiving enough heat from hot water inlet 4, until boiling. Heat is furnished so that only part of the water is ~~vaporised~~ vaporized in order to avoid excessive scales into the tubes. It is observed on figure 3 that the ~~vapour~~ vapor chamber 9 above the first upper tubesheet 63 of the first stage evaporator 61 is enlarged in order to permit the passage of the ~~vapour~~ vapor to the first stage vapor chamber 9 (Fig 3). ~~Chamber~~ Vapor chamber 9 is limited ~~on lateral~~ laterally by cylindrical shell 54, on top by flange 1 and the final upper tubesheet 73 of ~~second~~ the final stage evaporator 71, and on bottom by the [[base]] first bottom tubesheet 53.

Replace the paragraph beginning on page 5, line 17 with the following amended paragraph:

Boiling water and ~~vapour~~ vapor rises into the tubes 8, splashing on the plate 14 (Fig. 3). ~~Vapour~~ Vapor flows to the ~~second~~ final stage evaporator tubes 15 (Figs. 1 and 5) in the final cylindrical vertical tube bundle 72 of the final stage evaporator 71, here named Cylindrical Bundle Evaporator. Touching the outside of the tube walls, the ~~vapour~~ vapor condenses, giving up energy to boil the ~~second~~ final stage salt water within the tubes 15. The condensate produced on the outside of the tube walls is collected on the bottom of the chamber 9 (Fig. 3) and pumped to a storage tank through the coil 17 and the outlet 16, delivering sensible heat to the incoming salt water 6 through the coil 17, inside chamber 7.

Replace the paragraph beginning on page 5, line 27 with the following amended paragraph:

~~Second~~ Final stage is fed by the remaining not ~~vaporised~~ vaporized first stage salt water, suctioned by the ~~second~~ final stage lower pressure through tube 18, pouring into the tray 19, and flashing ~~vapour~~ vapor. Tube 18 collects salt water from the bottom of an extended pipe, in order to keep an adequate water column, to avoid suction of ~~vapour~~ vapor from the first stage. On the tray, water directs to the central tube 20, dropping to floating head 21, feeding ~~second~~ final stage tube bundle [[15]] 72. Central tube 20 has also the function to force a circulation of liquids to all tubes of the evaporator. Tray 19 and plate 14 prevent rising salt water droplets to reach the demisters 22 (first stage) and 23 (~~second~~ final stage). Both plate 14 and tray 19 are removable in order to permit access to the tube sheets.

Replace the paragraph beginning on page 6, line 9 with the following amended paragraph:

~~Second~~ Final stage fresh water is obtained through the ~~vapour~~ vapor condensation on condenser 2, being collected in the container 24 within the final vapor chamber 75 contained in the final stage upper vessel 76. Through outlet nozzle 25 (Fig.1), distilled water condensate is pumped to reservoir. Inside condenser tubes circulates cold salt water through inlet nozzle 26 (Fig. 1), leaving on nozzle outlet 27. Here, a stream of salt water is derived in order to feed the first stage feed chamber 7 through inlet nozzle 6.

Replace the paragraph beginning on page 6, line 16 with the following amended paragraph:

Level of residual undistilled salt water is maintained on the first stage upper tubesheet 63 of the first stage evaporator 61 by the weir 28. In the same way, ~~second~~ final stage residual water level is maintained on the final upper tubesheet 73 by weir 29. Salt

water that overboards weir 29 exits the unit through outlet 30, being suctioned by eductor 10 (Fig. 1) to discharge 31 (Fig.1).

Replace the paragraph beginning on page 6, line 26 with the following amended paragraph:

A thin steel shell 35 (Fig. 5), here named final stage ~~armour~~ armor 35, which is assembled in two halves by flanges, encloses ~~second~~ the final stage cylindrical vertical tube bundle 72. The role of this ~~armour~~ armor 35 is to direct the ~~vapour~~ vapor from the first stage evaporator tubes 8 to pass from the first stage vapor chamber 9 through the final cylindrical vertical tube bundle 72 in the final stage evaporator 71, partially condensing on the outsides of the final stage evaporator tubes 15, avoiding being suctioned directly to vacuum pipe 11 (Fig. 1). The welded edge 36 (Fig. 5) supports the ~~armour~~ armor 35 at the top of the first stage ~~inner shell 3~~ internal wall 39. A gasket bonded ~~bellow~~ below the edge avoids ~~vapour~~ vapor leakage.

Replace the paragraph beginning on page 7, line 9 with the following amended paragraph:

~~Three stages~~ A three stage model 56 (Fig. 10) has the same two stage constructive philosophy, with a new intermediate stage evaporator included, here named Ring Evaporator Bundle (Fig. 13), that becomes the second stage evaporator 81 with ring tube bundle 47, and is inserted into the first stage evaporator 61. The cylindrical evaporator (Fig. 5), becomes now the third stage, but remains the final stage evaporator 71 of the model 56, and is inserted into the second stage Ring Evaporator tube Bundle 47 (Fig. 13).

Replace the paragraph beginning on page 7, line 16 with the following amended paragraph:

The first stage evaporator 61' of this three stage model 56 (Figs. 10, 11) is similar to the two stage model 55, but the base 38 (Fig. 11) is now welded to the ~~inner and outer~~ internal and external ~~shells~~ walls 39 and 40 respectively (Fig. 11), in order to have a reliable watertight. At the ~~centre~~ center of this base 38 is welded a support 41 (Figs. 11 and 12), in order to hold and ~~centralise~~ centralize the intermediate second stage (Fig. 13).

Replace the paragraph beginning on page 7, line 23 with the following amended paragraph:

On this model 56, vacuum lines 42 and 43 (Fig.11) and condensate (distillate) outlets 44 and 45, are located ~~bellow~~ below the unit, in order to permit easy access of second and third stages.

Replace the paragraph beginning on page 7, line 28 with the following amended paragraph:

~~Ring Evaporator Bundle~~ The second stage evaporator 81 ring tube bundle 47 has also an ~~armour~~ armor 46 (Fig. 13), in order to direct the first stage ~~vapour~~ vapor to the tubes 85 of its tube bundle 47. Floating head 48 has [[on]] in this way a ring format also, as shown on figure 14 (bottom view) and figure 15 (section view). An internal [[shell]] wall 49 with upward extension 87 and an external shell 50 enclose ~~encloses~~ the second stage vapor chamber 84 and isolate the ~~vapour~~ vapor inside this stage.

Amend the following paragraph that was previously inserted on page 8, between lines 6 and 7:

A one stage desalinator can be assembled by just inserting the condenser 2 inside ~~vapour~~ vapor chamber 9.

Replace the paragraph beginning on page 8, line 7 with the following amended paragraph:

~~Four stages~~ A four stage model 57 including a third stage evaporator 91 is represented in a section view on figure 16. Now, another ~~Ring Evaporator Bundle~~ third stage evaporator 91 ring tube bundle 47' is included, as an intermediate stage between the second stage evaporator 81 and the final stage evaporator 71 of the four stage model 57, compounding in this way the four stage model, and so on.

Add the following new paragraphs beginning on page 8, after line 10, following the paragraph above:

In the four stage model 57, the illustrated third stage evaporator 91 with the third ring tube bundle 47' and the second stage evaporator 81 with the second ring tube bundle 47 are identical, except for their dimensions. The second ring tube bundle is of larger diameter and the third ring tube bundle is of longer length than in the three stage model, as required by the configuration of the four stage model 57 illustrated in Figure 16.

Figure 17 of the drawings illustrates the third stage evaporator 91 wherein primed numerals indicate features equivalent to those of the second stage evaporator 81 and the third ring tube bundle 47', except for dimensions, which are varied to suit. Thus, the third ring tube bundle 47' includes a third upper tubesheet 82' and a third bottom tubesheet 83', which seal and support opposite ends of the tubes 85' of the bundle. A third stage vapor chamber 84' is defined above the third upper tubesheet 82' and annularly around the upward extension 87' of the third stage internal wall 49'. The third stage vapor chamber 84' is laterally restrained by an outer shell 50' and on top by flange 1 and final upper tubesheet 73 of the final stage evaporator 71.

An annular tray 88' above the third upper tubesheet 82' acts as a splash guard for vapor and salt water discharged from the third stage tubes 85' into the third stage vapor chamber 84'. The tray 88' also receives residual salt water vacuumed from the previous stage vapor chamber and drains the water through a tube 89' to a floating head

48' carried on the third bottom tubesheet 83'. Vapor from the previous second stage vapor chamber 84 is directed by a third stage armor 46', surrounding the tube bundle 47', to pass through the tube bundle 47', discharging heat to the salt water in the tubes 85' to partially vaporize the water therein and deliver vapor and residual salt water to the third stage vapor chamber 84'. Some of the vapor contacting the outside of the tubes 47' condenses thereon and drains to the bottom of the third stage evaporator 91, where it is drawn off as condensate through a condensate outlet 45' and pumped to storage.

It should be understood that the operation of the second and third stage evaporators is consecutive and identical. The second stage receives vapor into its tube bundle 47, which is partially condensed on the second tubes 85 and condensate is drawn off from the condensate outlet 45 and pumped to storage. The residual salt water from the second stage is suctioned to the third stage vapor chamber 84', passed to the third stage floating head 46', drawn upward through the third stage evaporator tubes 85' and heated therein by the second stage vapor to form more vapor and residual salt water for use in the final stage evaporator 71.